The Design and Integration of a Distributed Fan Propulsion System within a Split-Wing, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

A baseline propulsion system has been designed as a starting point in a previous SBIR effort for this project which consists of two turboshaft engines, a generator coupled directly (no gearbox) with each engine, and electric cables to motors that drive shrouded fans installed in or over the wing. For this baseline, there are eight fans per wing, and the turboshaft engines use kerosene fuel as the energy source. One major issue faced by this type of configuration is the propulsion integration of not only the structure with motors in a split wing, but also the aerodynamics of such a configuration. In the previous study, high pressure recovery inlets, exhaust nozzle area control, thrust vectoring and variable pitch fans were considered, along with the initial layout of the entire structural integration. The work proposed here aims to further address these concerns and outline a potential fan, inlet and nozzle design methodology for split-wing distributed propulsion. This methodology can be turned into a design tool, for which the framework will be created as part of this study to be fully completed in a possible Phase II. In addition, and most important to this topic, several aerodynamic aircraft concepts have also been looked at under currently supported work with California Polytechnic State University on their N+2 NRA contract to study future CESTOL aircraft and during internal study efforts at ESAero. The work proposed here will complement much of that work by taking a better look at some novel integration arrangements in the configurations. This will specifically address overall vehicle efficiency by looking at the aerodynamic concepts inherently designed into the aircraft. This will be an important part of the study, as a properly integrated distributed propulsion system will offer the means to reduce "specific" fuel consumption, thereby increasing aircraft operating efficiencies to reduce overall mission fuel burn.

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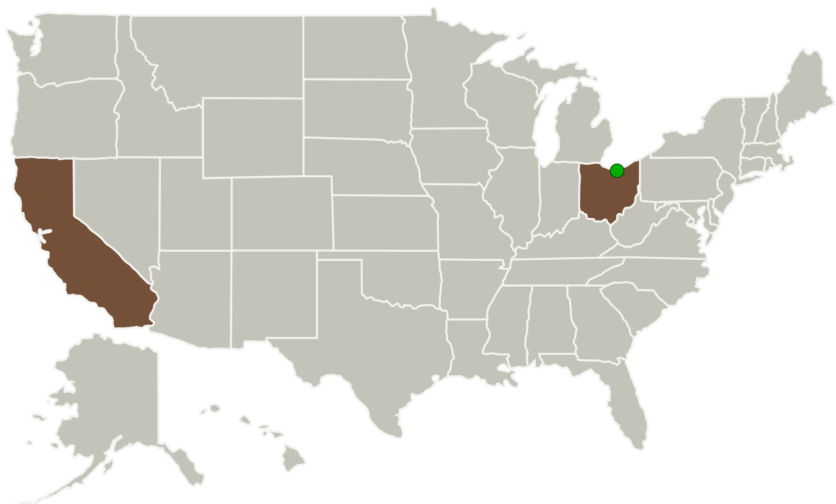
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Empirical Systems Aerospace, Inc.(ESAero)	Lead Organization	Industry	Pismo Beach, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/138536)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Empirical Systems Aerospace, Inc. (ESAero)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

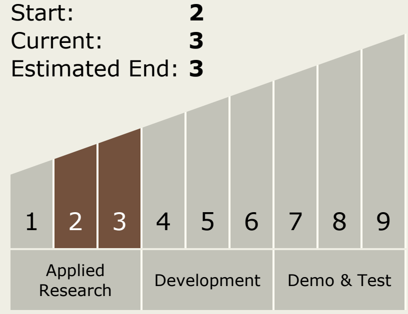
Carlos Torrez

Principal Investigator:

Mark A Waters

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  └─ TX01.3 Aero Propulsion
    └─ TX01.3.9 Hybrid Electric Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System